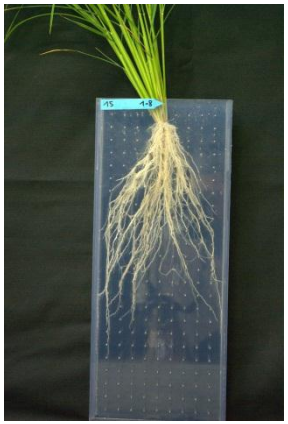
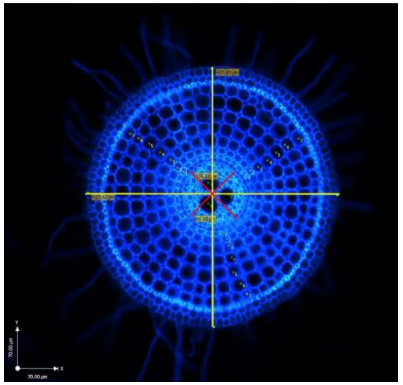
Root system structure

A. Audebert

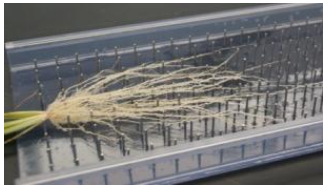
2nd Global Rice Phenotyping Network Worshop

IRRI 22-24 November 2012





Rhizoscope :
A phenotyping system for root dynamics



Objective : Adult plants phenotyping

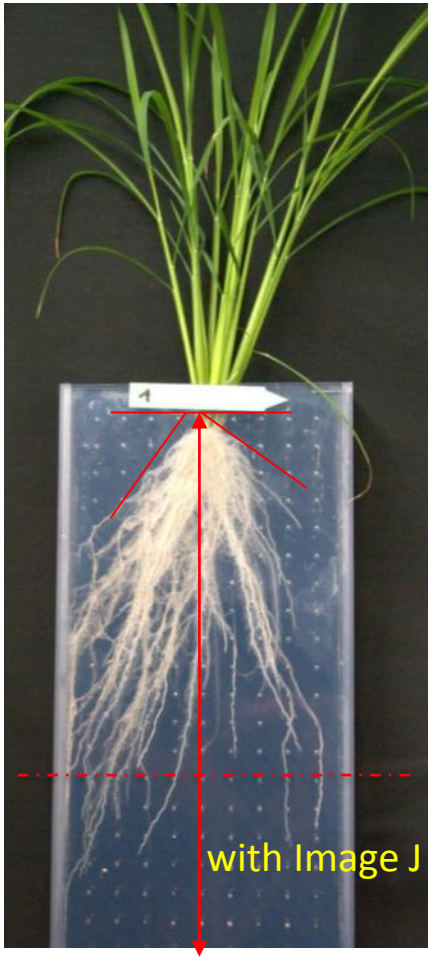
Principle : Mixed hydroponic system with glass beads as inert substrate

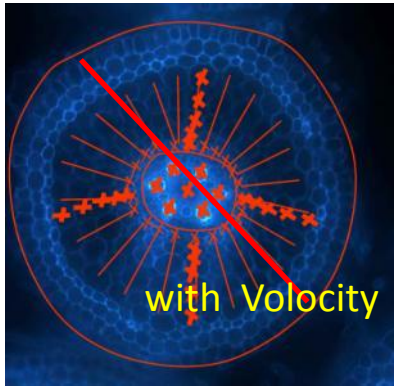
- Transparent Plexiglas boxes (50 cm x 20 cm x 2 cm) with a grid of nails
- Filled with 1.5 mm diameter glass beads = inert substrate providing mechanical resistance.
- Automatic control of pH and temperature of the nutrient solution

- Medium throughput system: 4 tanks holding each 48 plants (192 plants)
- Plants up to 30 days old

What traits can be monitored?

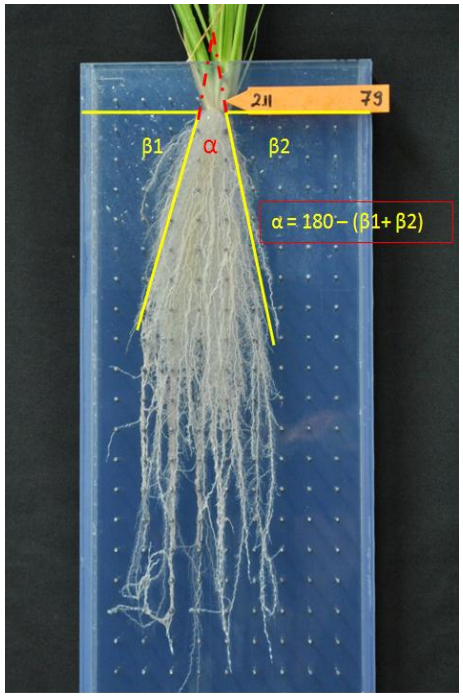
- Manually or through image analysis:
  - Shoot traits
    - Leaf length; number of tillers per plant; leaf number; shoot biomass;
  - Root traits:
    - Maximum crown root depth; root mass at different depths; crown root number at depth; root cone angle
  - Root /shoot ratio; root mass per tiller
- Fluorescence microscope on crown root tips
  - Root diameter; stele area; nb of xylem vessels; diameter of xylem vessels; nb of mesodermis layers

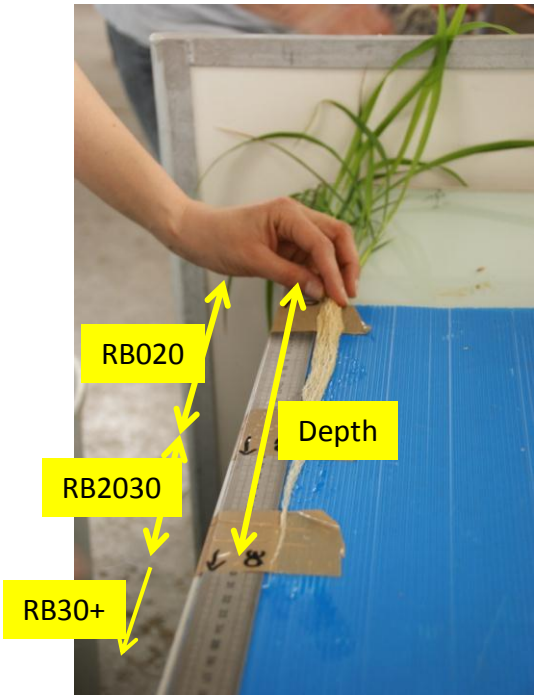




Phenotyping experiments

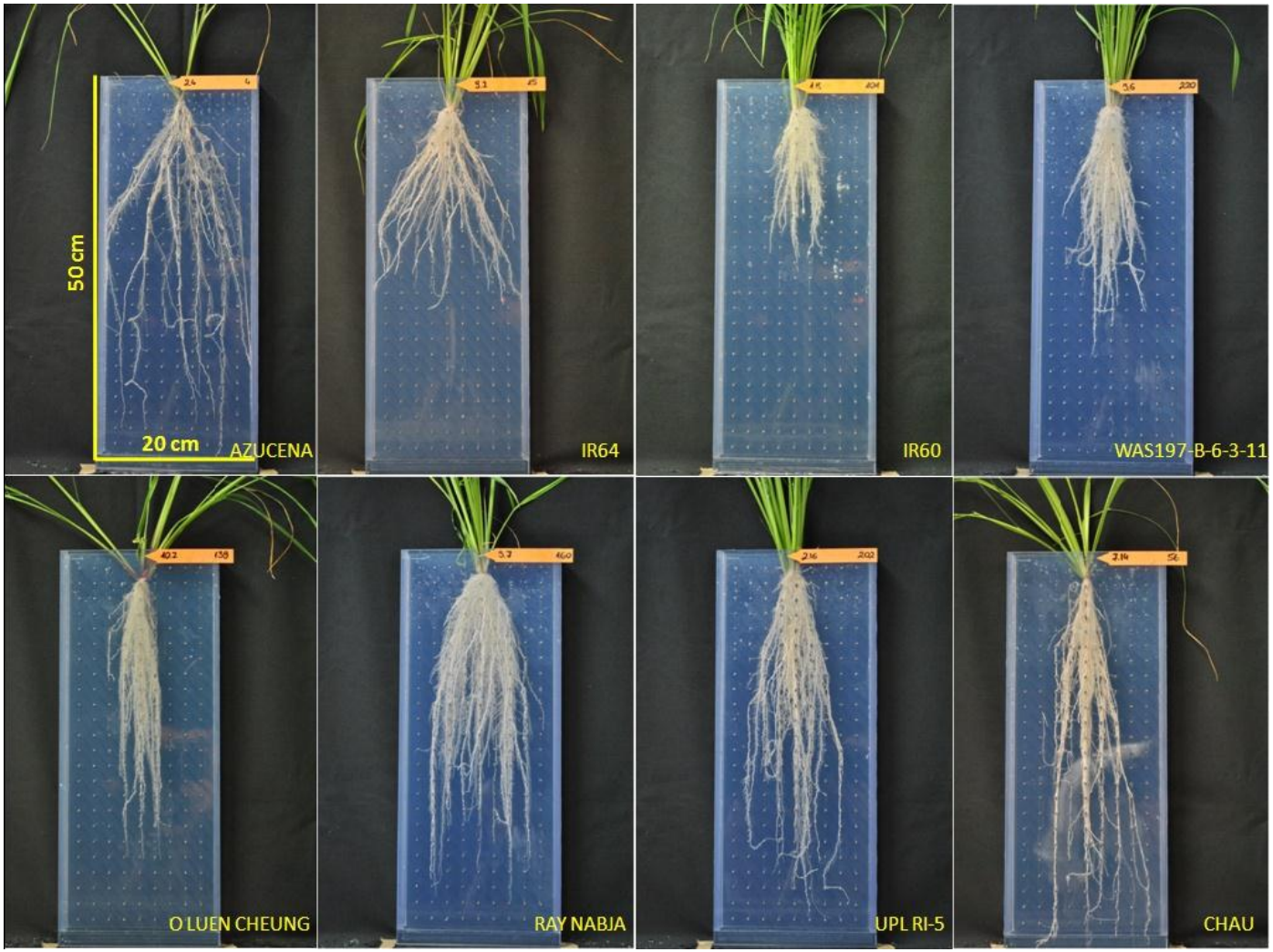
- 2011 and 2012
- Orytage and Grips funds
- Japonica and Indica panels (172 varieties phenotyped)
- 2 checks varieties (IR64 and Azucena) replicated in each tank
- 2 replications in time
- 30 days growth
- Traits
  - Shoot biomass
  - Root cone angle
  - Maximum root depth
  - Root nb at 30 cm depth
  - Root biomass
    - 0-20
    - 20-30
    - 30-50
  - Anatomy
    - Root tip





Rhizoscope platform : Some results

(indica panel, 200 acc.)



Rhizoscope platform : Some results

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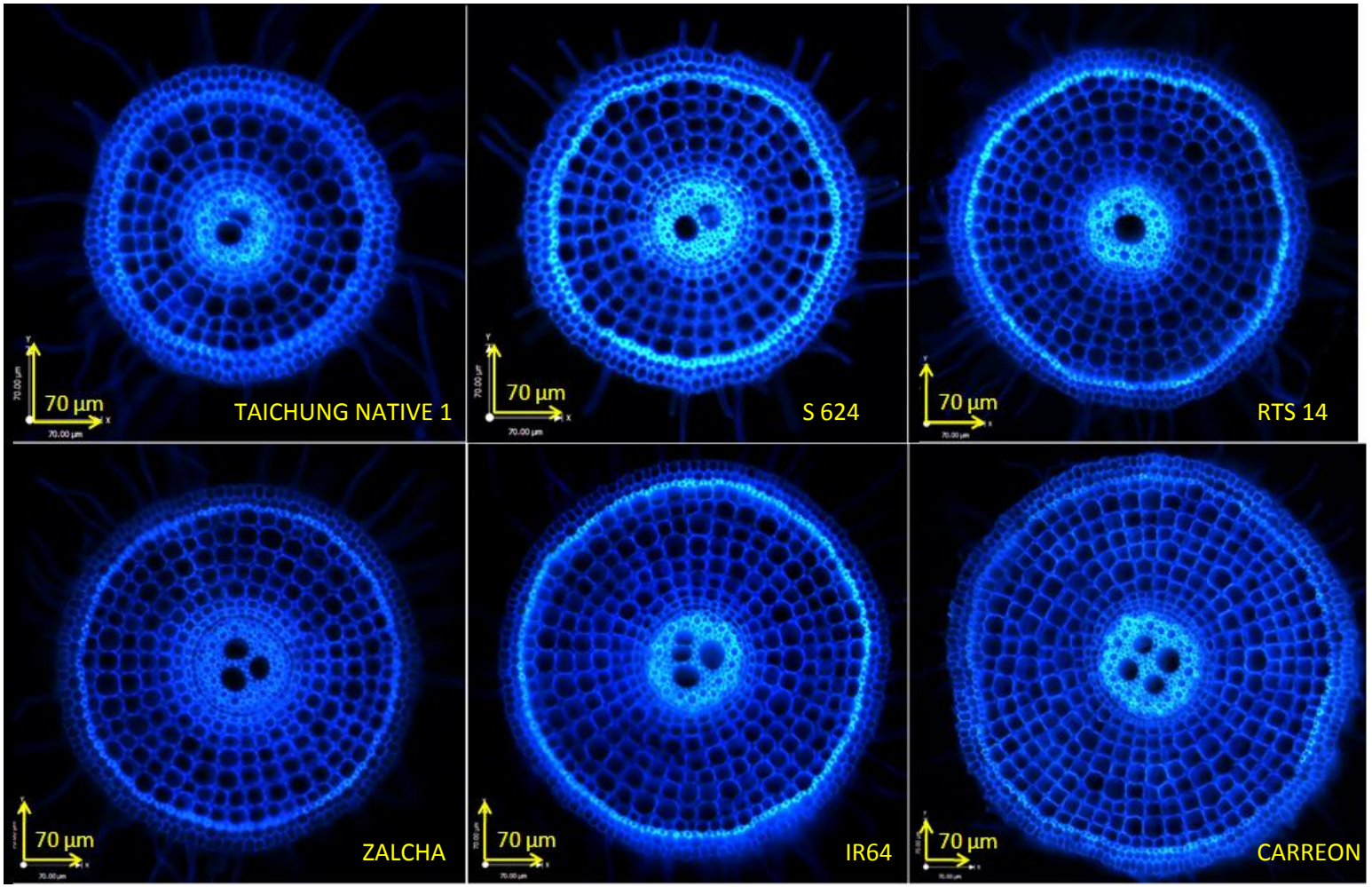
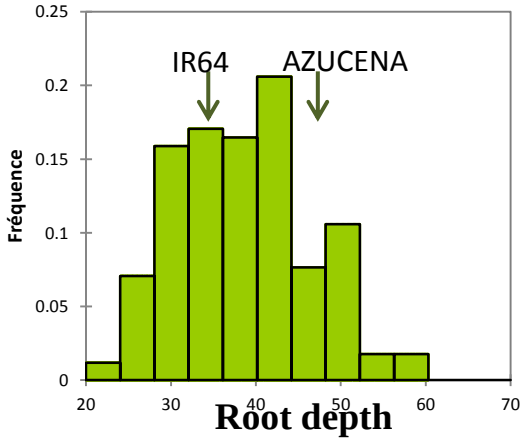
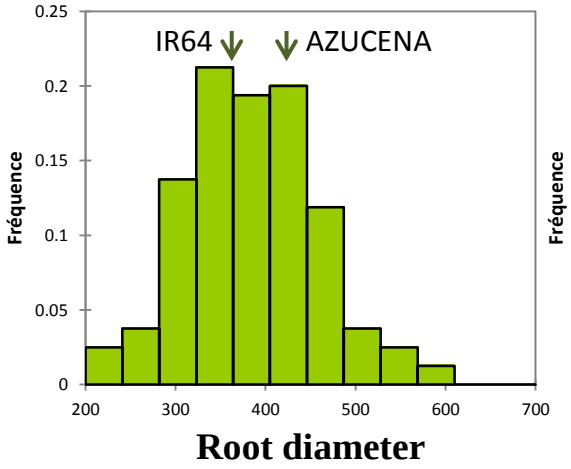
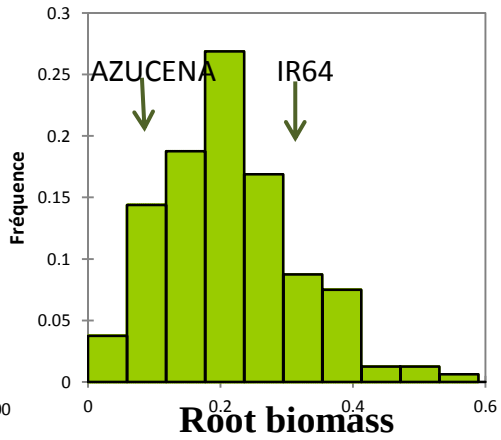


Rhizoscope platform : Some results

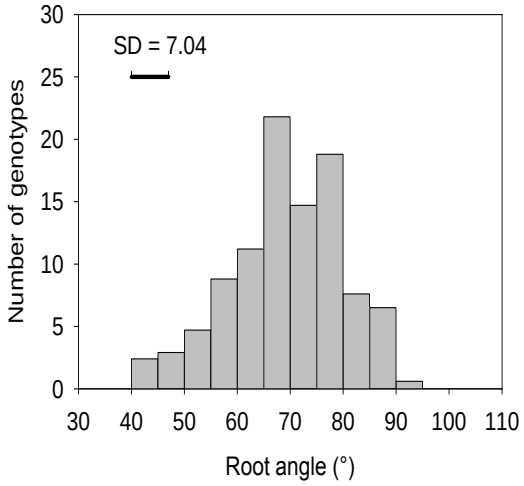
Indica panel

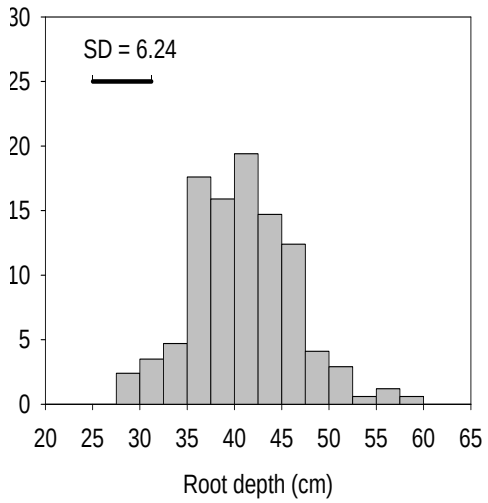


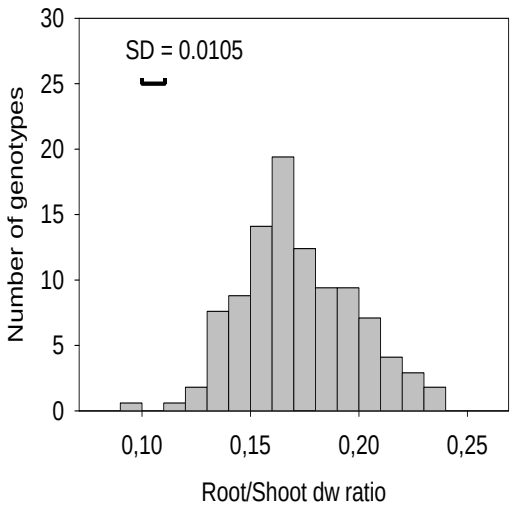




japonica panel



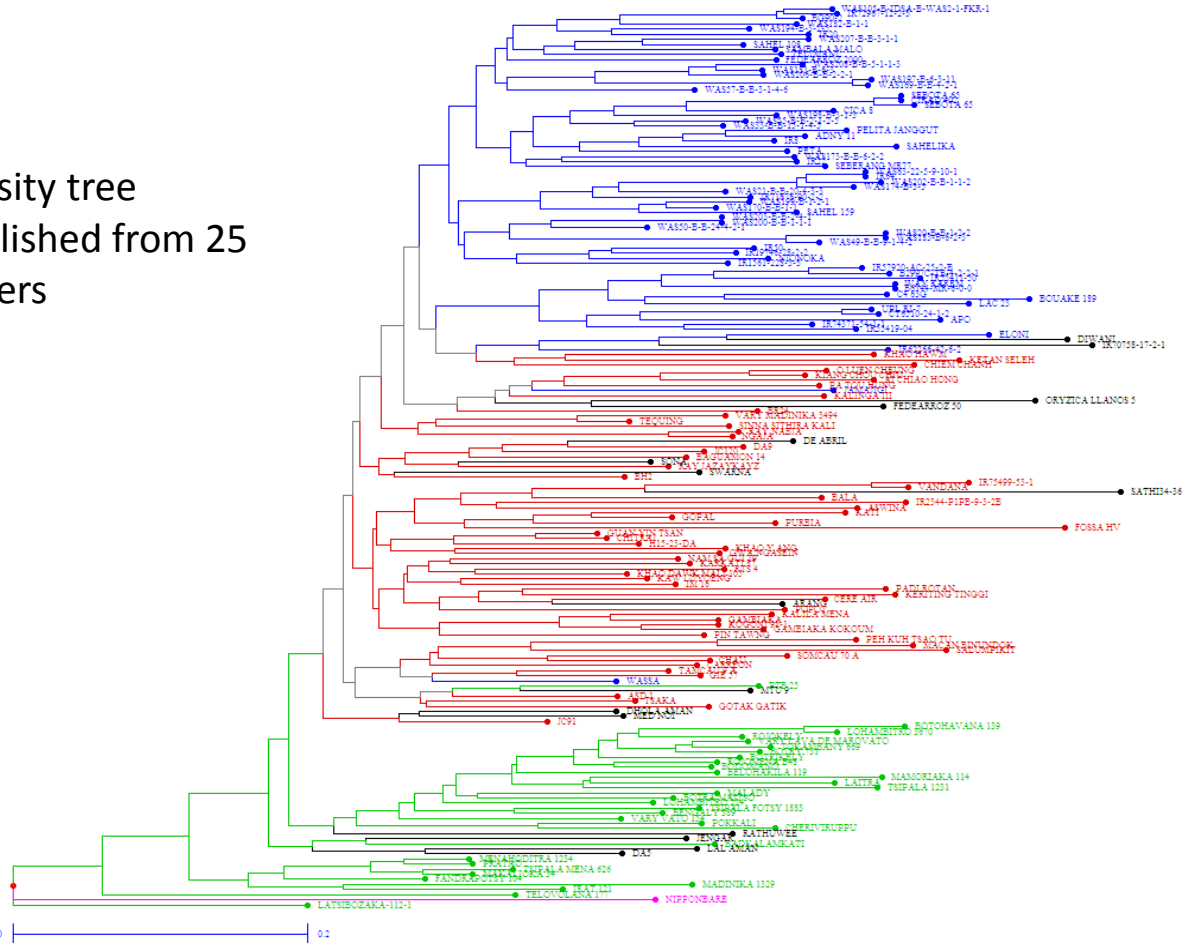




How explain the indicas diversity ?

Available information for theses varieties: Type (traditional or improved); Geographical origin (large region); Genetic group

Diversity tree established from 25 Markers



Sub-population 2 : Improved indicas from Africa and Asia

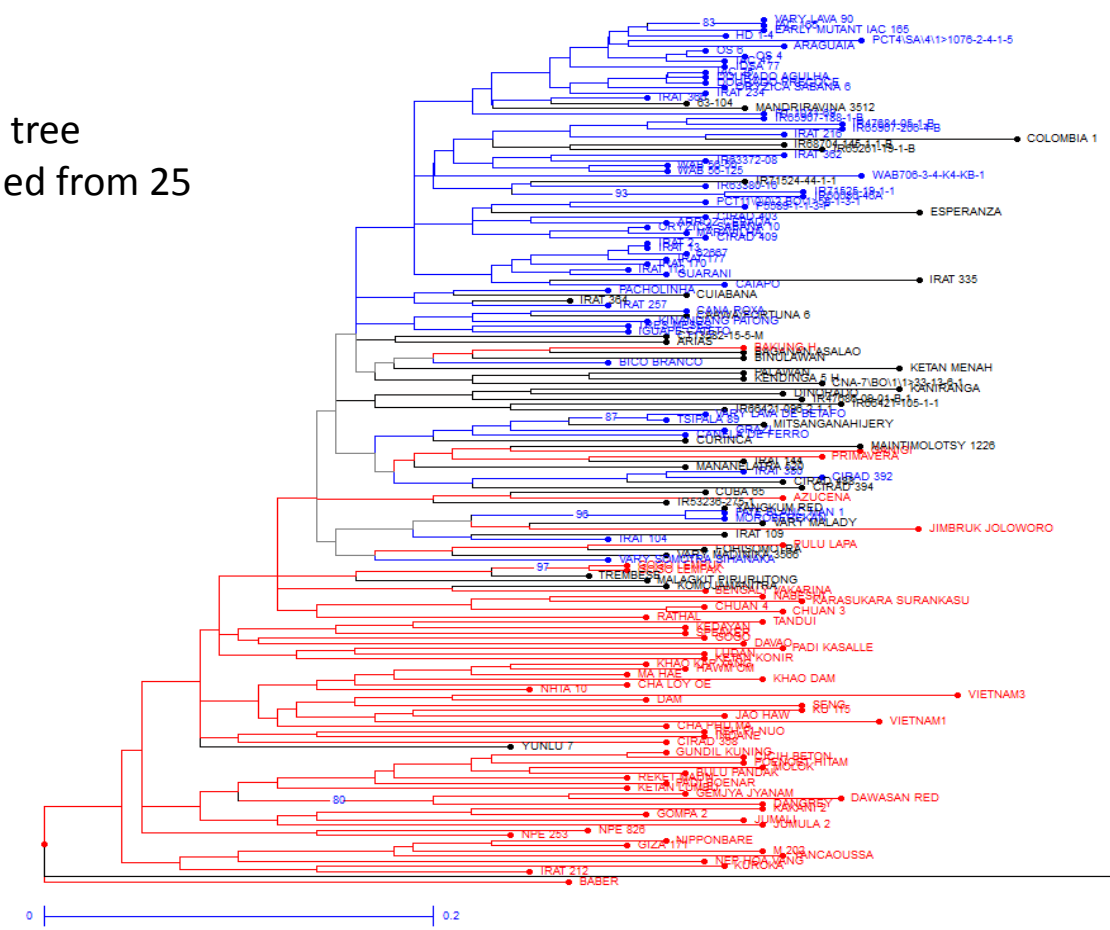
Sub-population 3 : Traditional Indicas from Asia

Sub-population 1 : Indicas from Madagascar

How explain the japonicas diversity ?

Available information for theses varieties: Type (traditional or improved); Geographical origin (large region); Genetic group

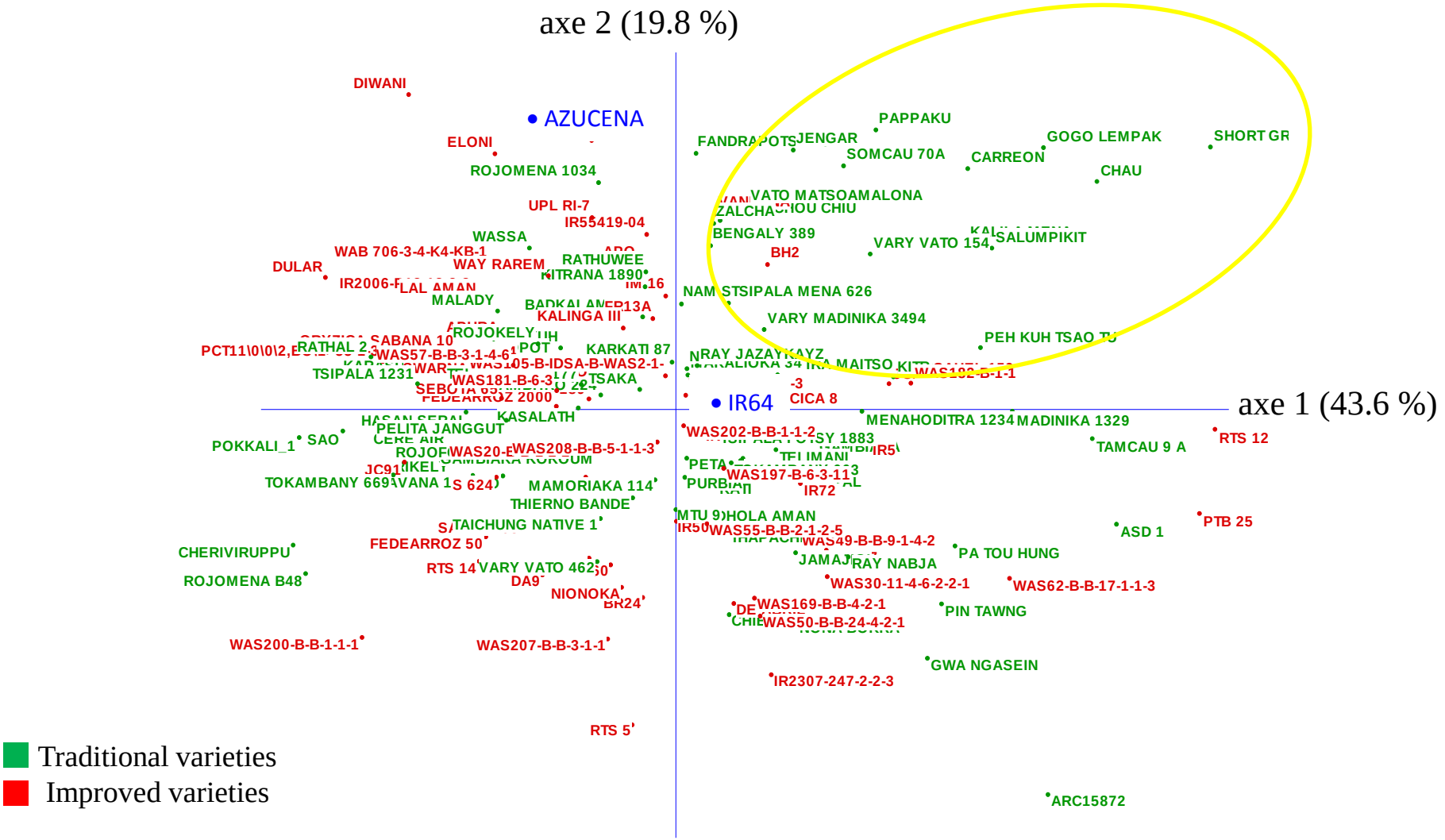
Diversity tree established from 25 Markers



Sub-population 2 : Japonicas from Africa and South America

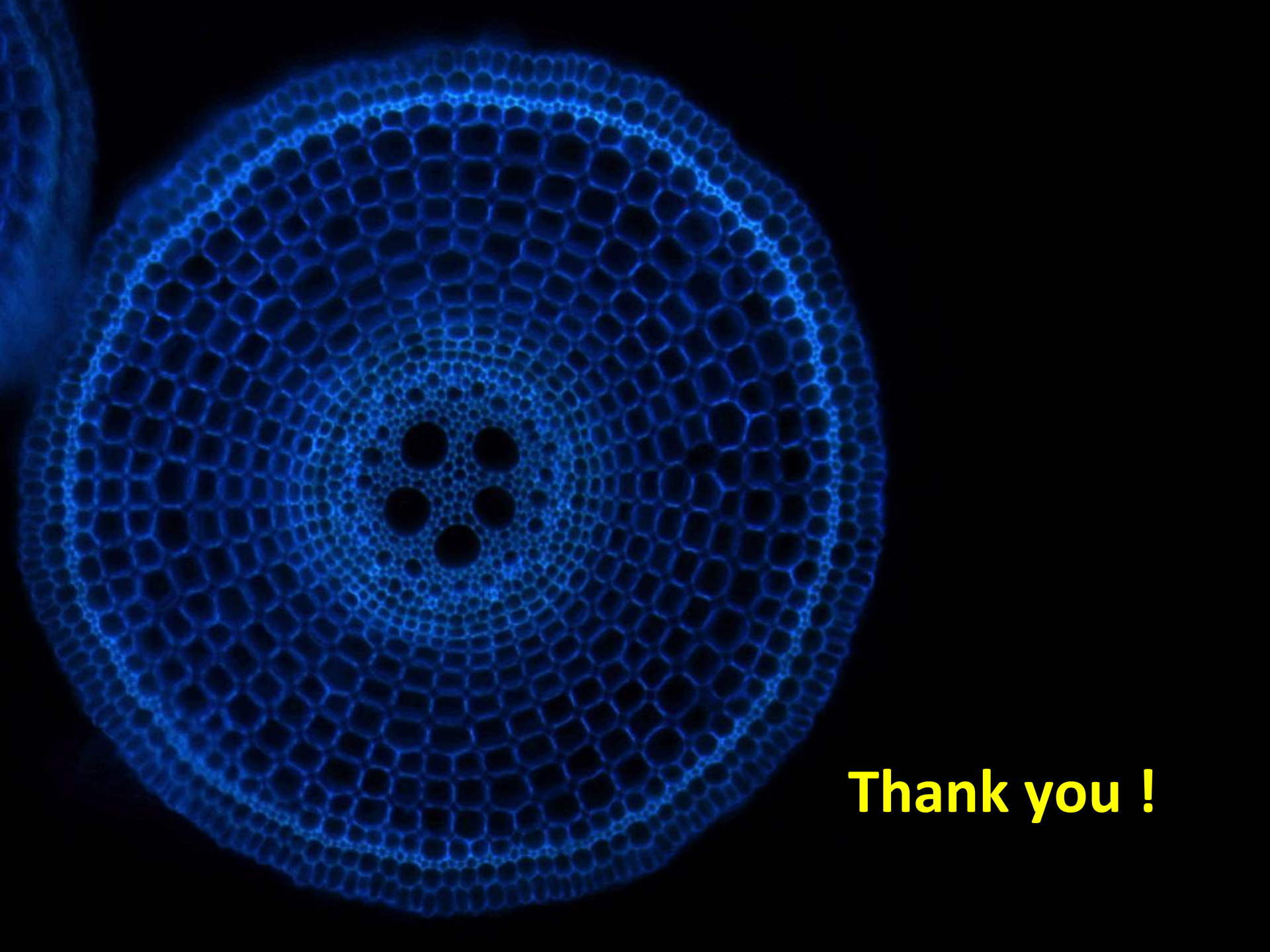
Sub-population 1 : Japonicas from Asia

PCA analysis



Next step

- Association study
  - With the SNPs genotyping data
- Improved the picture analysis
  - System
  - Software
- Growth condition
  - Nutrient
    - Salt, N, P
  - Abiotic
    - pH, temp, 02, impedance
- Improved beads capillarity


Thank you !